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REPORT OF MULTISPECIES ASSESSMENT TASK, COLLECTION OF SQUIDS AND FISHES AND OBSERVATIONS OF SEABIRDS AND MARINE MAMMALS BETWEEN SAN DIEGO AND MONTEREY, CALIFORNIA

by

John B. Hedgepeth

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INTRODUCTION

The purpose of the multispecies assessment task of the Oceanic Fisheries Research Division at the Southwest Fisheries Center is to study faunistic and environmental relationships primarily in the eastern tropical Pacific Ocean (ETP). The group had an opporunity to collect data during an El Niño period on Cruise 166 of the NOAA research vessel David Starr Jordan in Pacific Ocean waters off California from August 15 to September 1, 1983. This opportunity allowed the group to test gear and methods which were intended for use in the region of primary interest, the ETP, at a later time. Reported here are the methods and locations of capture of gillnet- and troll-caught fishes and gillnet-caught squids, observations of marine mammals and seabirds, and collections of stomachs of fishes and seabirds made on Cruise 166. Figure 1 shows the general area sampled, offshore Southern California.

MATERIALS AND METHODS

A concise cruise report is given in Appendix I. The report lists the itinerary, objectives, methods and general results of Cruise 166. Squid and fish sampling gear consisted of 1) two experimental gillnets of nylon monofilament, designed to capture squids by entrapping them between their posterior fins and anterior mantle, 2) four experimental gillnets of nylon multifilament, designed to sample albacore size/depth stratification , 3) two automatic squid jigging machines, and 4) trolled handlines with artificial lures for catching albacore. In addition, we dipnetted juvenile squid, which had congregated below attractant lighting. Seabird and marine mammal sightings were recorded during 54 hours of observation. Several seabirds were collected by shotgun from the ship's outboard motor powered Boston Whaler for analysis of gut contents and for contribution to specimen series maintained by the Los Angeles County Museum.

Fish and shark stomachs and whole squids were collected and preserved by freezing in the ship's freezer except for three of the squids which were preserved in liquid nitrogen for biochemical analysis by another Southwest Fisheries Center group who intend to investigate stock differentiation.

Gillnets

Monofilament Nylon Gillnets

Prior to Cruise 166, the two monofilament gillnets were constructed at the Southwest Fisheries Center from six shackles (sections of net) of salmon gillnet, provided by the Northwest and Alaska Fisheries Center, and two shackles of modified herring gillnet, purchased for the project. Each shackle was a section of light green, nylon monofilament netting, bordered by floats, floatline and leadline. Each shackle measured approximately 50 m in length and 8 m in depth. Two shackles were fabricated from 0.51 mm diameter monofilament sewn into 5.4 cm stretch mesh, three shackles were made of 8.3 cm mesh using 0.41 mm line, and three shackles were formed from 11.4 cm mesh using 0.51 mm monofilament. One net was constructed from one 11.4 cm stretch mesh shackle, two 8.3 cm mesh shackles, and one 5.4 mesh shackle. The other net included two 11.4 mesh shackles, one 8.3 mesh shackle, and one 5.4 mesh shackle. Only the first of these two nets was used and the other served as a backup in case of damage.

Each end of the monofilament gillnet was bridled. The bridle was attached to 30 m long, 1.3 cm diameter, polypropelene pickup lines. The ends of the pickup lines were attached to marker poles which had radar reflectors and strobe lights. During a few sets of the gillnet, a radio beacon was attached in place of a marker pole assembly. The gillnet was a non-sinking type, which fished from the surface to a depth of eight meters. Five orange Polyform[1] floats were clipped to the floatline as the net was launched to provide extra buoyancy and visibility.

The gillnet was launched at the ship's stern either by hand or by reeling it off a hydraulically powered drum. To retrieve the gillnet, one of the pickup lines was tied to the drum and the net was reeled into the ship. Fishes and squid were removed from the net astern of the drum.

Multifilament Nylon Gillnets

Four multifilament nylon gillnets were also used during Cruise 166. The four nets were each 0.4 km long, 6.1 m deep, and incorporated several stretch mesh sizes (10.2, 12.7, 15.2, 17.8, 20.3, 22.9 and 25.4 cm) using approximately 0.7 mm diameter light green multifilament nylon line. These nets were deployed from the hydraulically powered drum and the depth fished was regulated by the length of "dropper" lines attached to Polyform[1] floats. Depth fished varied between sets from the surface to 66.4 meters. The multifilament gillnets were part of an experiment designed to sample albacore populations.

Automatic Squid Jigging Machines

Two Hamade[1], electric powered, squid jigging machines were installed on the port and starboard rails directly abeam of the ship's propellers. Each machine controlled two eccentric drums from which jigging lines were let down.

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[1] Reference to trade names does not imply endorsement by National Marine Fisheries Service, NOAA.

The eccentric drums provided an oscillating motion as lines were deployed and retrieved. A jigging line consisted of 100 m of 150-pound test nylon monofilament leader, a swivel, 30 squid jigs, each separated by 1 m of 100-pound test monofilament nylon, and ending with another swivel and 0.9 kg oval lead weight. Machines were operated by dialing a depth between 0 and 150 m, and lines were released to that depth and retrieved automatically.

We positioned a lighting assembly for attracting squids above each machine. Each lighting assembly included six, 100 watt mercury vapor floodlamps mounted on aluminum, steel, and wood composite frames. The frames pivoted inboard so that the beams of light would intersect the ship's gunnel and a shadow would be cast on the surface of the water shipward from the point where the jigging lines entered the water. The lighting scheme created a type of shadow zone under the ship from which squids have been reported to attack the jigs (Hamabe et al. 1982).

Trolling

Trolling for groups of albacore was a common daytime activity on board the Jordan. Vessel speed was approximately six knots while trolling. Generally, ten, hand-operated jig lines with artificial lures were deployed.

Seabird and Marine Mammal Sightings

Robert Pitman, a scientist from the Los Angeles County Museum, observed marine mammals and seabirds an average of three hours each day during the cruise. He used two, 25-power binoculars, which were mounted on each wing of the flying bridge approximately 11 m above sea surface, for his observations. He also systematically recorded geographic positions, vessel heading, vessel speed, and seasurface temperature and salinity using the ship's computer system.

RESULTS

The cruise track made by RV David Starr Jordan is illustrated in Figure 1. After leaving San Diego on August 15, the ship proceeded to the north side of Santa Cruz Island, where the gillnets were launched by hand from temporary bundles on the deck. They were then reeled back onto the hydraulic drum for subsequent settings. Collecting activities and marine mammal and seabird observations were made as far north as the Guide Seamount (36°45 N, 123°01 W). The vessel returned to San Diego on September 1.

Gillnet Sets

Table 1 gives locations and dates of gillnet sets for both monofilament and multifilament gillnets. These locations are also indicated in Figure 1. The monofilament net was fished on 6 occasions, and multifilament nets were set 16 times. Animals were captured in all 6 sets of the monofilament gillnet, and 11 of the 16 sets of the multifilament nets. Table 2 lists all animals caught by gillnets. Stomachs were collected from 31 of the 62 fish

captured, and all 19 squid (Ommastrephes bartramii) were preserved whole. Eighteen of these squid were frozen (one in liquid nitrogen); and we preserved another squid in formalin for identification purposes. We preserved stomachs from 15 blue sharks (Prionace glauca), 3 bonito sharks (Isurus oxyrinchus), 1 hammerhead shark (Sphyrna zygaena), 1 common thresher shark (Alopias vulpinus), 10 skipjack tuna (Katsuwonus pelamis), 1 bonito (Sarda chiliensis) and 1 yellowfin tuna (Thunnus albacares).

Trolling

Table 3 lists locations and dates of capture for fishes caught by trolling. Capture locations listed were approximated from trolling position notes and from the cruise track records. We preserved, by freezing, stomachs from 21 skipjack tuna, 41 bonito and 94 albacore tuna (Thunnus alalunga) which were caught by the trolling gear.

Squid Jigging Machines

Machines were run one to two hours in evening and early morning hours, although no catches resulted. On August 18, five juvenile squids (Gonatopsis borealis) were dipnetted under the squid attracting lights. Two of these were frozen in liquid nitrogen; the others were preserved in formalin.

Seabird and Marine Mammal Data

Over 13,284 individual seabirds were recorded during Cruise 166. Table 4 lists daily seabird sightings and also species totals for the cruise. Sooty shearwaters were the most common seabird observed, followed by unidentified storm-petrels, unidentifed shearwaters, pink-footed shearwaters, black storm-petrels, arctic terns, murrelets and New Zealand shearwaters.

About 4,172 marine mammals were sighted (Table 5). The majority of animals seen were common dolphins (3,564 individuals). Approximately 95 rorquals were observed comprising 43 blue whales, 5 fins, 1 minke, and 46 unidentified balaenopterids.

We were able to launch the ship's Boston Whaler on three days to collect seabirds. On August 18, 10 sooty shearwaters and 1 pink-footed shearwater were collected. One New Zealand shearwater and 2 arctic terns were shot on August 20. On August 21, we collected another 2 arctic terns.

DISCUSSION

The two automatic squid jigging machines failed to catch squid. Possibly, we may have been fishing in areas depauperate in squids such as the larger ommastrephid squids that are attracted to jigging gear. Most of the cruise was not far offshore, whereas large, epipelagic squids, especially O. bartramii, are usually found farther offshore. Nontheless, we did catch a few large squids by gillnet.

When we caught several squids in the gillnet, we were not able to run the

jigging machines because of weather conditions. On August 22 we attempted to jig for squids but winds of 16-18 knots made fishing unmanageable because jig lines streamed down from the ship at 45 degrees on the weather side. Winds increased on August 23 and we did not attempt to fish for squids. Weather conditions improved the next day and we ran the machines soon after we launched a gillnet in which two squids were caught. This was a small catch when compared with the previous set, which may indicate that the density was lower on this occasion.

Adequateness of lighting and length of time jigging might have also influenced the lack of success with the jigging machine. While jigging for squids near the Hawaiian Islands, the Hokusei Maru used 11, four kW halogen lights to provide lighting for three machines (Suzuki and Matsumoto 1981). The resulting light intensity was over ten times the lighting per machine we used on the David Starr Jordan. Jigging sessions on the Hawaiian cruise lasted between 2 and 11 hours, whereas we operated our two machines for only 1 to 2 hours per session.

The stomachs of fish may be effective sampling devices of squids (Clarke 1983). By sampling with nets or other squid collecting devices at the same time one may be able to assess differences in the sampling techniques. We were interested primarily in sampling larger squids such as the ommastrephids, and there are indications that the larger fishes, the sharks, may prey upon these squids (Tricas 1979, Clarke and Stevens 1974). Indeed, the stomach contents of one large blue shark examined so far contained the same species of squid (O. bartramii) we captured in the gillnet.

The August cruise took place during an El Niño period, which is characterized by warm water anomalies, among other conditions. Examination of these stomachs could prove useful to our understanding of changes in food web relations due to these atypical oceanic conditions. We are preparing an analysis of food habits of the fishes captured during Cruise 166 for comparison with reported food habits during non-El Niño periods.

We are also reevaluating the efficacy of our sampling gear and hope to conduct tests on the sampling gear in the eastern tropical Pacific (the area of primary interest) in the future.

The data of bird sightings are also being analyzed. An initial impression made during the cruise was that certain types of birds were seen in areas where albacore were present, while other bird types were seen with and near bonito. We are investigating the possibility of using bird sighting cues to aid in searching for albacore in the future.

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Table 1. Depth, position, time of day and outcome of gillnet sets made during Cruise 166 of the RV David Starr Jordan, August 15 to September 1, 1983.

Set	Depth (m)	Latitude (degrees, minutes) N	Longitude (degrees, minutes) W	Set Start (day,time) DST#	Haul Finish (day, time) DST#	Duration (hrs)	Animals captured
6	4.6	35 09	121 37	8/18 0610	8/18 1118	5.1	No
7	4.6	35 09.3	121 36.6	8/18 0635	8/18 1257	6.4	Yes
8	4.6	35 20.9	121 40.4	8/19 0230	8/19 0753	5.4	Yes
9	18.3	35 20.8	121 39.2	8/19 0300	8/19 2048	17.8	No
10*	0.0	35 11.5	122 10.2	8/20 0425	8/20 0845	4.3	Yes
11	18.3	35 08.7	122 16.8	8/20 1225	8/20 1758	5.6	Yes
12	66.4	35 08.0	122 18.1	8/20 1310	8/20 1852	5.7	Yes
13	61.0	35 08.0	122 16.7	8/21 0218	8/21 0913	6.9	Yes
14	18.3	35 07.1	122 17.7	8/21 0300	8/21 1045	7.8	Yes
15	4.6	35 06.5	122 18.6	8/21 0332	8/21 1135	8.0	No
16*	0.0	35 05.4	122 19.3	8/21 2307	8/22 0715	8.1	Yes
17*	0.0	35 50.3	122 03.5	8/24 1955	8/25 0942	13.8	Yes
18	4.6	35 49.4	122 02.5	8/25 0015	8/25 0820	8.6	No
19	18.3	36 44.7	123 00.9	8/26 0855	8/26 1540	6.8	Yes
20*	0.0	36 44.1	123 00.2	8/26 0920	8/27 0712	21.9	Yes
21*	0.0	33 46	119 16	8/29 0105	8/29 1048	9.7	Yes
22	18.3	33 45	119 17	8/29 0137	8/29 0836	7.0	No
23	34.1	33 45	119 17	8/29 0212	8/29 0923	7.2	No
24	0.0	33 32	119 09	8/29 1939	8/30 0922	13.7	Yes
25	4.6	33 31	119 09	8/29 2005	8/30 1137	15.5	Yes
26*	0.0	32 38	117 57	8/31 0019	8/31 0930	9.8	Yes
27	4.6	32 39	117 58	8/31 0046	8/31 0853	9.6	No

* monofilament gillnet designed to catch squids
# DST = daylight savings time, GMT = DST + 7 hours

Table 2. Animals captured in gillnet sets during Cruise 166 of RV David Starr Jordan, August 15 to September 1, 1983.

Set	Species	Sample Number	Fork or Mantle Length (cm)	Preserved or Stomach Collected	Sex	Mesh Size (cm)	Gilled/ Tangled
7	Prionace glauca	7-1	144	yes	m	15.2	both
8	P. glauca	8-1	157	yes	m	22.9	
	P. glauca	8-2	139.5	yes	m	12.7	
	Sarda chiliensis	8-3				12.7	gilled
	S. chiliensis	8-4				12.7	gilled
	S. chiliensis	8-5	59.7	yes		12.7	gilled
	P. glauca	8-6	170.5	yes	m	12.7	tangled
	P. glauca	8-7	109	yes	m	20.3	tangled
	P. glauca	8-8	108	yes	m	20.3	tangled
10*	Isurus oxyrinchus	10-1	112	yes	m	11.4	tangled
11	P. glauca	11-1	77	yes		10.2	tangled
	P. glauca	11-2				10.2	tangled
12	P. glauca	12-1	136	yes	m	20.3	gilled
13	P. glauca	13-1	72	yes	m	15.2	gilled
	Icosteus aenigmaticus	13-2	32.3	yes		10.2	gilled
14	Alopias vulpinus	14-1	178	yes	f	15.2	gilled
	P. glauca	14-2	72.6	yes	f		gilled
16*	P. glauca	16-1				11.4	gilled
	Ommastrephes bartramii	16-2	26	yes		11.4	gilled#
	O. bartramii	16-3	26	yes		8.3	gilled#
	I. oxyrinchus	16-4	118	yes	m	8.3	tangled
	O. bartramii	16-5	23.5	yes		8.3	gilled#
	P. glauca	16-6	54.8	yes	f	8.3	gilled
	O. bartramii	16-7	23.5	yes		8.3	gilled#
	O. bartramii	16-8	22.5	yes		8.3	gilled#
	O. bartramii	16-9	26	yes		8.3	gilled#
	O. bartramii	16-10	23	yes		8.3	gilled#
	P. glauca	16-11	74.8	yes	f	8.3	
	O. bartramii	16-12	23	yes		8.3	gilled#
	P. glauca	16-13	56.1	yes	f	8.3	gilled
	O. bartramii	16-14	23.5	yes		8.3	gilled#
	O. bartramii	16-15	25	yes		5.4	gilled#
	O. bartramii	16-16	27	yes		5.4	gilled#
	Sphyrna zygaena	16-17	223		f	5.4	tangled
	O. bartramii	16-18	25	yes		5.4	gilled#
	O. bartramii	16-19	22.5	yes			gilled#
	O. bartramii	16-20	23	yes			gilled#
	O. bartramii	16-21		yes			gilled#
17*	O. bartramii	17-1	24	yes		8.3	gilled#
	O. bartramii	17-2	28	yes		8.3	gilled#
19	I. oxyrinchus	19-1	114	yes	m	12.7	tangled
	P. glauca	19-2	106	yes	m	15.2	gilled

Table 2. (continued)

Set	Species	Sample Number	Fork or Mantle Length (cm)	Preserved or Stomach Collected	Sex	Mesh Size (cm)	Gilled/ Tangled
20*	O. bartramii	20-1	20	yes			gilled#
	P. glauca	20-2	67.5		m		
	P. gllauca	20-3					
	O. bartramii	20-4	24	yes			gilled#
	P. glauca	20-5	69	"			
21*	Katsuwonus pelamis	21-1	47.4	yes		5.4	tangled
	K. pelamis	21-2	48.6	yes		8.3	gilled
	K. pelamis	21-3	52.3	yes		11.4	gilled
	K. pelamis	21-4	48.8	yes		11.4	gilled
	K. pelamis	21-5	48.4	yes		11.4	gilled
	K. pelamis	21-6	50.3	yes		8.3	gilled
	K. pelamis	21-7	47.5	yes		11.4	gilled
24	Scomber japonicus	24-1	23.6			12.7	gilled
	S. japonicus	24-2	26.4			12.7	gilled
	S. japonicus	24-3	24.4			12.7	gilled
	S. zygaena	24-4	167	yes	f	15.2	tangled
	Engraulis mordax	24-5				12.7	tangled
	S. japonicus	24-6	30			20.3	gilled
	E. mordax	24-7				15.2	tangled
	S. japonicus	24-8	34			15.2	gilled
	S. japonicus	24-9	21.0			15.2	gilled
	Thunnus albacares	24-10	59.2	yes		15.2	gilled
	Mobula sp.						tangled
25	S. japonicus	25-1	37.7			15.2	
	S. japonicus	25-2	19.6			10.2	
	S. japonicus	25-3	25.0				tangled
	P. glauca	25-4	161.5	yes	m	25.4	
	S. japonicus	25-5	28.3			17.8	
	S. japonicus	25-6	31.3			20.3	
26*	Cypselurus hubbsi	26-1	31.5			5.4	gilled
	C. hubbsi	26-2	31.0			5.4	gilled
	C. hubbsi	26-3	31.9			5.4	gilled
	C. hubbsi	26-4	33.0			5.4	gilled
	C. hubbsi	26-5	30.0			5.4	gilled
	C. hubbsi	26-6	34.3			5.4	gilled
	C. hubbsi	26-7	31.5			5.4	gilled
	C. hubbsi	26-8	31.2			5.4	gilled
	K. pelamis	26-9	52.4			11.4	gilled
	K. pelamis	26-10	52.8			11.4	gilled
	K. pelamis	26-11	53.9			11.4	gilled

* monofilament gillnet designed to capture squids
# "gilled" by posterior fins

Table 3. Fishes caught with trolling gear during Cruise 166 of RV David Starr Jordan, August 15 to September 1, 1983. Stomachs were preserved from all except those noted. Positions are given by ranges of latitude and longitude.

Sample Number	Date	Species	Fork-length (cm)	Latitude to Latitude (deg. & min. N)		Longitude to Longitude (deg. & min. W)	
1	8/17	Thunnus alalunga	67	35 06	35 12	121 35	121 40
2	"	"	63	"	"	"	"
3	"	"	67	"	"	"	"
4	"	"	64	"	"	"	"
5	"	"	63	"	"	"	"
6	"	"	65	"	"	"	"
7	"	"	65.5	"	"	"	"
8	"	"	67.3	"	"	"	"
9	"	"	64.6	"	"	"	"
10	"	"	63.4	"	"	"	"
11	"	"	64.6	"	"	"	"
12	"	"	77.9	"	"	"	"
13	"	"	63.8	"	"	"	"
14	"	"	63.1	"	"	"	"
15	"	"	67.7	"	"	"	"
16	"	Sarda chiliensis	61.3	35 08		121 40	
17	"	"	59.7	"		"	
18	"	"	59.9	35 13		121 36	
19	"	"	60.8	"		"	
20	"	"	61.9	"		"	
21	"	"	62.0	"		"	
22	"	T. alalunga	61.9	"		"	
23	"	"	57.5	"		"	
24	"	"	62	35 13	35 20	121 36	121 51
25	"	"	63	"	"	"	"
26	"	"	67.2	"	"	"	"
27	"	"	67.9	"	"	"	"
28	"	"	78.8	"	"	"	"
29	"	"	63.0	"	"	"	"
30	"	"	65.9	"	"	"	"
31	"	"	59.9	"	"	"	"
32	"	"	61.2	"	"	"	"
33	8/18	T. alalunga	66.8	35 09		121 37	
34	"	S. chiliensis	57.9	"		"	
35	"	"	59.1	"		"	
36	"	"	64.8	"		"	
37	"	"	60.2	35 10		121 38	
38	"	"	59.3	"		"	
39	"	"	60.4	"		"	
40	"	"	58.6	"		"	
41	"	"	62.8	"		"	
42	"	"	58.7	"		"	

Table 3. (continued)

Sample Number	Date	Species	Fork-length (cm)	Latitude to Latitude (deg. & min. N)		Longitude to Longitude (deg. & min. W)	
43	8/18	S. chiliensis	60.1	35 10		121 38	
44	"	"	60.4	35 07	35 12	121 38	121 42
45	"	"	62.5	"	"	"	"
46	"	"	59.1	"	"	"	"
47	"	"	63.2	"	"	"	"
48	"	"	59.4	"	"	"	"
49	"	"	56	"	"	"	"
50	"	"	59.8	"	"	"	"
51	"	"	60.2	"	"	"	"
52	"	"	61.7	"	"	"	"
53	"	"	64.0	"	"	"	"
54	"	"	61.1	"	"	"	"
55	"	"	57.4	"	"	"	"
56	"	"	60.3	"	"	"	"
57	"	"	59.5	"	"	"	"
58	"	"	56.3	"	"	"	"
59	"	"	60.1	"	"	"	"
60	"	"	58.2	"	"	"	"
61	"	T. alalunga	65.3	"	"	"	"
62	"	"	64.3	35 11		121 42	
63	"	"	69.2	"		"	
64	"	S. chiliensis	58.2	35 11	35 22	121 42	121 44
65	"	"	61.2	"	"	"	"
66	"	T. alalunga	75.5	35 22		121 44	
67	"	"	79.9	"		"	
68-69*	"	S. chiliensis	60	35 33	35 28	121 44	121 46
70	"	T. alalunga	53.4	35 28		121 46	
71	"	"	63.6	"		"	
72-73*	8/19	S. chiliensis	(61-60)	35 08	35 22	121 19	121 43
74	"	"	59	"	"	"	"
75	"	"	59	"	"	"	"
76	"	"	58	"	"	"	"
77	"	"	59	"	"	"	"
78-86*	"	"	(57-63)	"	"	"	"
(17 unrecorded bonito)				"	"	"	"
87	"	T. alalunga	74.5	"	"	"	"
88	"	"	78.4	"	"	"	"
89	"	"	75.3	"	"	"	"
90	"	"	79.6	"	"	"	"
91	"	"	74.7	"	"	"	"
92	"	"	77.5	"	"	"	"
93	"	"	79.1	"	"	"	"
94	"	"	62.5	"	"	"	"
95	"	"	65.8	"	"	"	"
96	"	"	66.4	"	"	"	"
97	"	"	61.7	"	"	"	"

Table 3. (continued)

Sample Number	Date	Species	Fork-length (cm)	Latitude (deg. & min. N)	to Latitude	Longitude (deg. & min. W)	to Longitude
98	8/20	T. alalunga	62.4	35 12		122 10	
99	"	"	61.5	"		"	
100	"	"	82	"		"	
101	"	"	56	35 12		122 10	
102	"	"	61.4	35 08	35 14	122 09	122 27
103	"	"	64.1	"	"	"	"
104	"	"	66.6	"	"	"	"
105	"	"	64.5	"	"	"	"
106	"	"	64.8	"	"	"	"
107	"	"	51.0	"	"	"	"
108	"	"	83.0	"	"	"	"
109	"	"	80.2	"	"	"	"
110	"	"	82.0	"	"	"	"
111	"	"	66.7	"	"	"	"
112	"	"	76.0	"	"	"	"
113	"	"	64.6	"	"	"	"
114	"	"	64.2	"	"	"	"
115	"	"	61.1	"	"	"	"
116	8/21	T. alalunga	82.6	35 06	35 20	122 15	122 30
117	"	"	67.7	"	"	"	"
118	"	"	62.0	"	"	"	"
119	8/22	T. alalunga	74.2	34 27	35 01	121 55	122 16
120	"	"	62.8	"	"	"	"
121	"	"	64.7	"	"	"	"
122	"	"	83.7	"	"	"	"
123	"	"	81.8	"	"	"	"
124	"	"	79.6	34 19	34 27	121 51	122 12
125	"	"	76.5	"	"	"	"
126	"	"	79.6	"	"	"	"
127	"	"	77.3	"	"	"	"
128	"	"	76.5	"	"	"	"
129	"	"	78.6	"	"	"	"
130	"	"	78.3	"	"	"	"
131	8/23	T. alalunga	78.7	35 00	35 24	121 32	121 43
132	"	"	79.1	"	"	"	"
133	"	"	78.4	"	"	"	"
134	"	"	81.3	"	"	"	"
135	"	"	74.6	"	"	"	"
136	"	"	80.0	"	"	"	"
137	"	"	78.5	"	"	"	"
138	"	"	84.0	"	"	"	"
139	"	"	76.5	"	"	"	"
140	"	"	82.0	"	"	"	"
141	"	"	75.0	"	"	"	"
142-143*	"	"	(76-83)	"	"	"	"

Table 3. (continued)

Sample Number	Date	Species	Fork-length (cm)	Latitude to Latitude (deg. & min. N)		Longitude to Longitude (deg. & min. W)	
144-149*	8/24	T. alalunga	(52-88)	35 29	35 52	121 49	122 04
150	"	"	53.5	35 55		122 04	
151	"	"	53.3	"		"	
152	"	"	54.8	"		"	
153	"	"	55.0	"		"	
154	"	"	52.6	"		"	
155-190*	8/25-8/28	"	(52-83)	33 59	36 44	120 44	123 01
191	8/29	Katsuwonus pelamis	47.8	33 22	33 34	118 59	119 14
192	"	"	49.0	"	"	"	"
193	"	"	48.8	"	"	"	"
194	"	"	46.5	"	"	"	"
195	"	"	46.7	"	"	"	"
196	"	"	46.4	"	"	"	"
197	"	"	46.9	"	"	"	"
198	"	"	48.3	"	"	"	"
199	"	"	47.3	"	"	"	"
200	"	"	46.9	"	"	"	"
201	"	"	47.7	"	"	"	"
202	"	"	49	"	"	"	"
203	"	"	49	"	"	"	"
204	"	"	47	"	"	"	"
205	"	"	47	"	"	"	"
206	"	"	47	"	"	"	"
207*	"	"	47	"	"	"	"
208	8/30	K. pelamis	49.6	33 32		119 08	
209	"	"	48	"		"	
210	"	"	52	"		"	
211	"	"	49.6	"		"	
212	"	"	47.8	33 02		118 23	
213	"	"	47.7	"		"	
214-215*	8/31	K. pelamis	(47-50)	33 04	33 07	118 03	118 10
216-222*	9/01	K. pelamis	(48-50)	32 37	32 52	117 40	117 56
223	"	T. albacares	60.4	"	"	"	"
224	"	"	56.0	"	"	"	"
225	"	"	58.4	"	"	"	"
226	"	"	56.8	"	"	"	"
227	"	"	59.8	"	"	"	"
228	"	"	56.8	"	"	"	"

* stomach was not collected

Table 4. Seabird sightings during Cruise 166 of RV David Starr Jordan, August 15 to September 1, 1983. "+" indicates sightings where no counts were made; "++" indicates frequent occurrence. No effort or sightings took place on August 26.

Seabird Code *	8/15 Count	8/16 Count	8/17 Count	8/18 Count	8/19 Count	8/20 Count	8/21 Count	8/22 Count	8/23 Count	8/24 Count	8/25 Count	8/27 Count	8/28 Count	8/29 Count	8/30 Count	8/31 Count	9/1 Count
ALBF			17			1	3	1	1	3	1	3	1				
ALCD			9														
AUCA	12	3															
AUCA/MUXA	1																
AURH				2	25	4	6	2	+								
COBR	+																
CODC															25	2	
CORM	+														1		
COWB				1										3	32		
DUCK						6											
FUNO				1													
GUHE	2	+	12	3	19	2	1			1	1			1	1		
GULL	2										1					1	4
GUSA	2		2	1	1											2	32
GUWE	15	+	1	1	3	3	1				2		1				1
JAEG		1	1		2		2	3	1	4	4		2	7	125	2	8
JALT/JAPA								1		3	3	9	1				1
JAPA			3				1				1	2					
JAPO	2		1	4	2		2	1	1	1		11					
MUCO					3						6	3	3				2
MUCR					6												
MUCR/MUXA	2		12	2	315	2		2		2	11						
MUXA						+		2									
NHLS				2													
PEBR	+	+	1	16	49	4					8	3	11	5	5	9	68
PHAL	50		1	2	43			1		2	11	34			2		
PHRE					4		4					1					
RAVI					1												
SHDV		++	2	1	1						3				1		55
SHNZ			68	11	6	4	10	15	32	84	27	35	5				
SHPF	5	+	62	78	403	2	3	9	101	6	5	2	140	4	11		3

Table 4. (continued)

Seabird Code *	8/15 Count	8/16 Count	8/17 Count	8/18 Count	8/19 Count	8/20 Count	8/21 Count	8/22 Count	8/23 Count	8/24 Count	8/25 Count	8/27 Count	8/28 Count	8/29 Count	8/30 Count	8/31 Count	9/1 Count
SHSO	1	2	4080	1775	664	3	1		26	9	684	103	73	1	8		1
SHSP			7						46	21	318	19	482				
SKUA				5	1	1			2			1	1				
SPAS					18						+			+	+		
SPBL	217	+	5	13	28	+	2	1	+	12	24	6	2	11	73	3	70
SPFT											2						
SPLE			19	6	9	17	21		1	10	+	5					
SPLS	220	+			8			1		+	10			1	6		54
SPSP	220		92	51	180	43	121	133	10	58	39	8	2	52	132	8	260
SWVG			1														
TBRB								1									
TEAR			10		1	+	261	44	2	31	47	8					
TEAR/TECO			24	34	18	28					99	80	1		1		9
TECO/TEFO	2																
TELE	1																
TERO	1																
TSRD					2												
WHIM					3					25							
Effort	1h45m	0	5h45m	2h10m	5h30m	1h35m	4h45m	6h40m	1h55m	7h25m	3h10m	4h35m	1h55m	3h10m	3h10m	2h00m	1h15m

* Seabird Species Codes and Total Sightings:

ALBF Black-footed Albatross	31	FUNO Northern Fulmar	4	MUCO Common Murre	9
ALCD unidentified Alcid	9	GUHE Heermann's Gull	46	MUCR Craveri's Murrelet	6
AUCA Cassin's Auklet	15	GULL unidentified Gull	36	MUCR/MUXA	348
AUCA/MUXA	1	GUSA Sabine's Gull	10	MUXA Xantus' Murrelet	2+
AURH Rhinoceros Auklet	39+	GUWE Western Gull	172+	NHLS Lesser Nighthawk	2
COBR Brandt's Cormorant	27+	JAEG unidentified Jaeger	27	PEBR Brown Pelican	179+
CODC Double-crested Cormorant	1	JALT Long-tailed Jaeger	-	PHAL unidentifed Phalarope	146
CORM unidentified Cormorant	35+	JALT/JAPA	26	PHRE Red Phalarope	9
COWB Cowbird	1	JAPA Parasitic Jaeger	16	RAVI Virginia Rail	1
DUCK unidentifed Duck	6	JAPO Pomarine Jaeger	22	SHDV Dark-vented Shearwater	63+

Table 4. (continued)

* Seabird Species Codes and Total Sightings (continued):

SHNZ	New Zealand Shearwater	297	
SHPF	Pink-footed Shearwater	834+	
SHSO	Sooty Shearwater	7431	
SHSP	unident. Shearwater	893	
SKUA	Skua	11	
SPAS	Ashy Storm-petrel	18+	
SPBL	Black Storm-petrel	467	
SPFT	Fork-tailed Storm-petrel	2	
SPLE	Leach's Storm-petrel	16+	
SPLS	Least Storm-petrel	71+	
SPSP	unident. Storm-petrel	1409	
SWVG	Violet-green Swallow	1	
TBRB	Red-billed Tropicbird	1	
TEAR	Arctic Tern	404+	
TEAR/TEFO		106	
TECO/TEFO		2	
TECO	Common Tern	-	
TEFO	Forster's Tern	-	
TELE	Least Tern	1	
TERO	Royal Tern	1	
TSRD	Ruddy Ternstone	2	
WHIM	Whimbrel	28	

Table 5. Marine mammal sightings during Cruise 166 of RV David Starr Jordan, August 15 to August 31, 1983. Effort was the same as is recorded in Table 4.

Mammal Code *	8/15 Count	8/16 Count	8/17 Count	8/18 Count	8/19 Count	8/20 Count	8/21 Count	8/22 Count	8/23 Count	8/24 Count	8/25 Count	8/26 Count	8/27 Count	8/28 Count	8/29 Count	8/30 Count	8/31 Count
DOCO	2030			6	14								14	1500			
DOLP							25						25				
DORI		25	8		33			18	3							12	
DORW					250		25										
DOWS					5		35										
MAMA																2	
PODA					4												
RORQ			7	4	4		5	8		16	2						
SEAL			2		9	2											
SECO	1																
SELP					4										1		1
SLCA														1			
WHBL			9	7	7	4	6	9				1					
WHCU							10			1							
WHFI				1	1		1	2									
WHMI	1																
WHPI	1																
WHSP?										8							
ZIPH								2									

* Marine Mammal Species Codes and Total Sightings:

DOCO Common Dolphin	3564	RORQ unidentified Balaenoptera	46	WHCU Cuvier's Beaked Whale	11
DOLP unidentified Dolphin	50	SEAL unidentified Otariid	13	WHFI Fin Whale	5
DORI Risso's Dolphin	99	SECO Common Seal (Phoca)	1	WHMI Minke Whale	1
DORW Right Whale Dolphin	275	SELP Elephant Seal	6	WHPI Pilot Whale	1
DOWS Pacific White-sided Dolphin	40	SLCA California Sea Lion	1	WHSP? probable Sperm Whale	8
MAMA unidentified Marine Mammal	2	WHBL Blue Whale	43	ZIPH unidentified Ziphiid	2
PODA Dall's Porpoise	4				

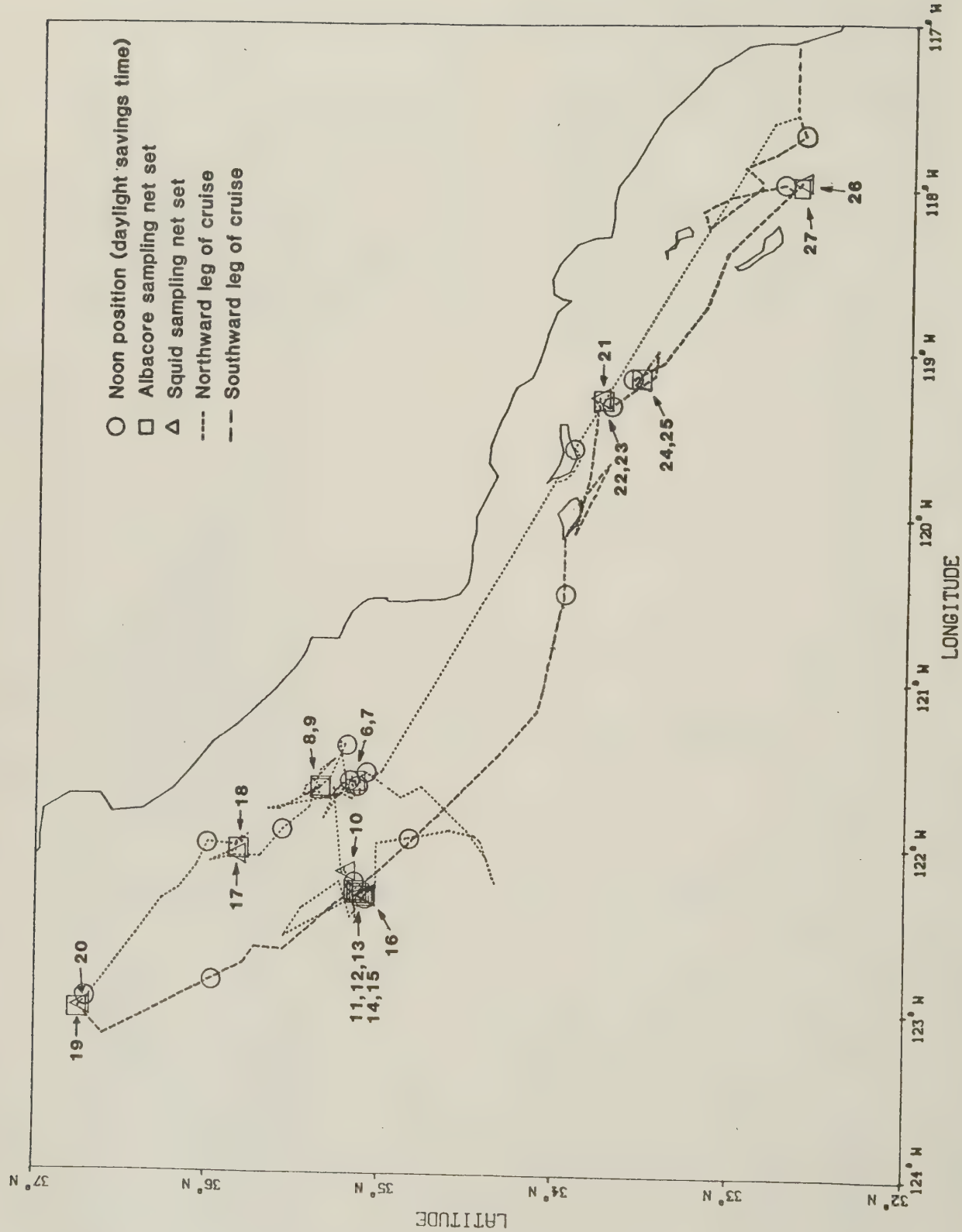

Figure 1. Cruise track and locations of gillnet sets for Cruise 166 of the RV David Starr Jordan, August 15 to September 1, 1983. The numbers 6 to 26 represent gillnet sets whose positions and dates are found in Table 1.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southwest Fisheries Center
P.O. Box 271
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CRUISE REPORT

VESSEL: R/V David Starr Jordan, Albacore Survey Cruise DS-83-07 (166)

CRUISE DATES: Departed San Diego, August 15, 1983
Arrived San Diego, September 1, 1983

ITINERARY: Vessel proceeded north from San Diego to the albacore fishing grounds between Pt. Conception and Monterey approximately 20 to 70 miles offshore. The vessel returned inside the Channel Islands. Figure 1 shows the approximate cruise track.

OBJECTIVES: The objectives of the cruise were:

(1) To sample the albacore population in each of several pre-determined vertical depth strata according to a pre-determined sampling plan with specially designed research gillnets. The sampling vicinity is shown in Figure 1.

(2) To sample the waters in the vicinity of the nets with a recording echo sounder.

(3) To sample the waters in the vicinity of the nets with trolled jigs.

(4) To evaluate the feasibility of scientifically sampling squid populations from the vessel using jigging machines.

(5) To collect all prescribed environmental, biological and sampling data.

(6) To gather data on squid predation by pelagic fishes and birds.

APPENDIX I

METHODS: Research gill nets, both multifilament and monofilament, were fished in various depth strata during both day and night. During days, jigs were trolled, sighting observations of birds and marine mammals were made, and echo sounding traces made. At night squid jigging machines were operated and echo sounding traces made. Biological data were taken on specimens captured.

RESULTS: A total of 27 gill net sets were made at depths ranging from 0 ft. to 212 ft. Sampling included squid, skipjack and yellowfin tunas, bonito, four species of sharks, plus other fishes. No albacore were taken by nets. Trolling operations produced approximately 130 albacore plus skipjack and yellowfin tunas, as well as bonito. Biological samples included gut contents, liver tissue, muscle tissue, otoliths, and various measurements were made. Echo sounding traces were inconclusive as to the presence of fish. Approximately 150 man-hours of bird and mammal sighting effort were documented. No squid were caught on jigging machines.

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Date 9/22/83

Prepared by Norman Bartoo
Norman Bartoo, Cruise Leader

Approved by Izadore Barrett
Izadore Barrett, Center Director

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Farrar, C7
Hitz, CPM12
David Starr Jordan, CPM443

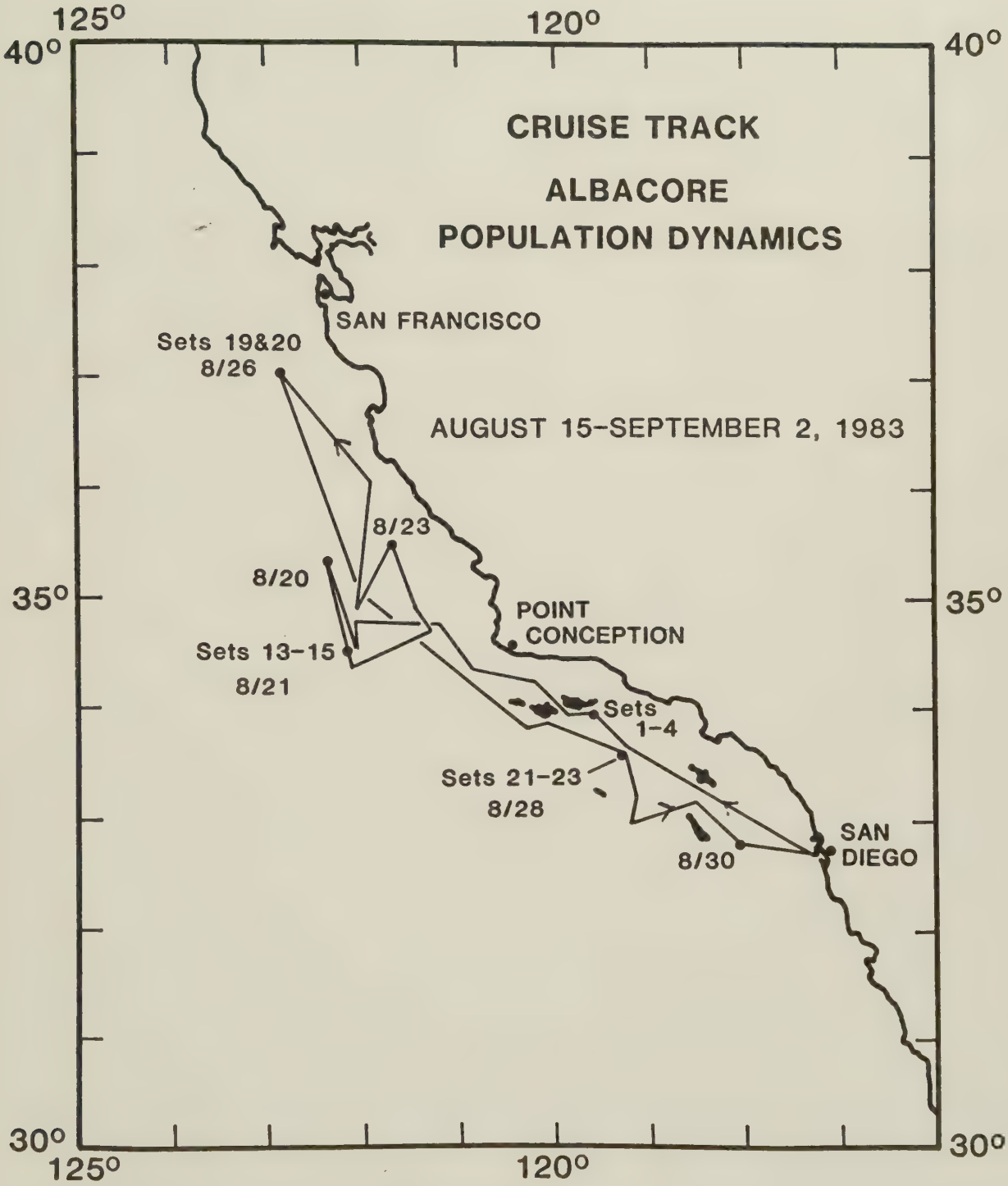

FIGURE 1. Vessel cruise track and area of major operations.